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Patent Claims

1.   A method for the mounting of an add-on part (3, 3'') on a workpiece (1, 1''), in particular on a vehicle body, the add-on part (3, 3'') being mounted on the workpiece (1, 1'') in a precisely positioned manner in relation to a reference region (12, 13, 12'', 13''),

-       in which method use is made of a mounting tool (5, 5''), which is guided by means of a robot (14, 14'') and comprises a fixing device (19, 19'') for picking up the add-on part (3, 3'') and a sensor system (20, 20''), which is connected fixedly to the mounting tool (5, 5'') and has at least one sensor (21, 21''),

-       the mounting tool (5, 5'') with the add-on part (3, 3'') held in the fixing device (19, 19'') firstly being moved, within the context of a positioning phase (A-2), from a proximity position (34, 34''), which is independent of the position of the workpiece (1, 1'') in the working area (24) of the robot (14, 14''), into a mounting position (25, 25''), in which the add-on part (3, 3'') held in the mounting tool (5, 5'') is aligned in a precisely positioned manner in relation to the reference region (12, 13, 12'', 13'') of the workpiece (1, 1''),

-       and the add-on part (3, 3'') then being connected in this mounting position (25, 25'') of the mounting tool (5, 5'') to the workpiece (1, 1''),

characterized in that, in order to approach the mounting position (25, 25''), an iterative control operation is run through, in the course of which

-       an (actual) measured value of the at least one sensor (21, 21'') is produced,

-       this (actual) measured value is compared with a (desired) measured value produced within the context of a setting-up phase,

-       a movement vector of the mounting tool (5, 5'') is calculated from the difference between the (actual) measured value and (desired) measured value using a Jacobi matrix calculated within the context of the setting-up phase,

-       the mounting tool (5, 5'') is displaced by this movement vector.

2.   The method as claimed in claim 1,
characterized in that the iterative control operation is terminated if

- either the deviation between the (desired) measured value and the (actual) measured value lies below a predetermined threshold value, or

- the reduction in this deviation that is to be achieved during consecutive iteration steps lies below a predetermined threshold value.

3.   The method as claimed in one of the preceding claims,

characterized in that a TCP/IP interface is used for the communication between a control device (16) of the robot (14, 14'') and an evaluation unit (29) of the sensor system (20, 20'').

4.   The use of the method as claimed in one of claims 1 to 3, characterized

in that the method is used for mounting a front module (3) into a front opening (1) of a vehicle body (2).

5.   The use of the method as claimed in one of claims 1 to 3, characterized

in that the method is used for mounting a roof module (3'') into a roof opening (2'') of a vehicle body (1'').

6.   A mounting system (4, 4'') for the mounting of an add-on part (3, 3'') on a workpiece (1, 1''), in particular on a vehicle body,

- having a mounting tool (5, 5'') guided with the aid of a robot (14, 14''),

- having a sensor system (20, 20''), which is connected fixedly to the mounting tool (5, 5'') and comprises at least one sensor (21, 21''),

- having a control device (16) for controlling the robot (14, 14'') and the mounting tool (5, 5''),

- and having an evaluation unit (29) for evaluating the measured values of the sensor system (20, 20''),

characterized in that at least one of the sensors (21, 21'') is a metrically uncalibrated sensor.

7.   The mounting system as claimed in claim 6,

characterized in that the at least one sensor (21, 21'') is an optical gap-measuring sensor.

8.   The mounting system as claimed in claim 6 or 7,

characterized in that the at least one sensor (21, 21'') is a contactlessly and two-dimensionally measuring sensor which uses luminous radiation in the UV range to record the surface area.